Frankly Speaking

Brake Emphasis Program

On April 15 the police of the nation will embark upon a country-wide program to encourage proper vehicle maintenance with special emphasis on brakes.

Through the International Association of Chiefs of Police, supported by approximately 100 national organizations, including the Institute of Traffic Engineers, and backed by 48 state enforcement committees, the brake emphasis program will affect millions of motorists. Such a focusing of attention on vehicle condition as a potential accident factor is sure to produce excellent results. Sixty-six lives were saved in Michigan last year in a similar program (see February issue of TRAFFIC ENGINEERING). A like reduction may be expected on a national scale if all interested groups will cooperate to the fullest extent.

Engineers should have a real interest in this program. They should help the police to interpret the program to the public before, during and after the campaign period by providing factual information relating to vehicle performance, characteristics, braking and accidents.

It is our sincere hope that every traffic engineer will participate in this national campaign between April 15 and June 1.

Harold V. Hammond

President, Institute of Traffic Engineers.

VOLUME XV MARCH, 1945 NUMBER 6

Braking Distances

by EARL ALLGAIER

IN PRACTICALLY all discussions of braking distances it has been assumed that the coefficient of friction between tires and road surfaces remains constant for various speeds. On this assumption the braking distance varies as the square of the speed. If the speed is doubled then the stopping distance would be four times as great.

In the comprehensive tests carried out on wet pavements by Professor R. A. Moyer of Iowa State College (described in bulletin 120 of the Iowa Engineering Experiment Station, Ames, Iowa) it is quite evident that the coefficient of friction as measured by towing tests is not constant for the various speeds but that it actually decreases with an increase in speed for the speeds investigated, namely, 10 to 40 miles per hour. Since the coefficient of friction does decrease it is evident that the braking distance varies not as the square of the speed but as the speed raised to some power greater than 2.00.

Relation of Speed and Friction Coefficients

In order to determine the formula for the braking distance dependent upon a variable coefficient of friction it is first necessary to determine the relationship between speed and the coefficient of friction.

From Professor Moyer's studies the coefficients of friction for speeds of 10, 20, 30 and 40 miles per hour were taken for 41 wet surfaces. While the curve is different for each surface an equation for each surface would be impractical and unusable. On the other hand a formula may be developed to describe the curve which is a general average of wet surfaces. This curve then used as a basis for computing braking distances should give more accurate results than calculations based on the assumption that the coefficient of friction is constant for all speeds.

The average coefficients of friction for 41 wet surfaces of various types, using both old and new tires, are given in table I.

TABLE I

Average Coefficients of Friction for Wet Surfaces at Various Speeds

Speed (m.p.h.)	Coefficient of Friction
10	0.621
20	0.502
30	0.432
40	0.389

A glance at the curve plotted from these figures (See Fig. 1) indicates that the coefficient probably varies as some power of the speed. In other words the equation would be of the form:

$F = k V^x$ where F = Coefficient of friction
k = A constant
V = Speed in m.p.h.
x = An unknown constant

By taking logarithms of both sides the equation is changed to:

$$\text{Log } F = \text{Log } k + x \text{ Log } V$$

This is equivalent to the familiar equation of a straight line: $y = mx + b$. By the method of least squares it is now possible to find the best fitting curve for the four points determined experimentally. The final equation for the coefficient of friction at any speed now becomes:

$$F = \frac{1.377}{V^{0.3408}}$$

As a check on the accuracy of the formula the coefficients as determined by the formula and those obtained

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experimentally are given in table II. These two sets of figures are also shown graphically in the chart below.

TABLE II

Calculated and Actual Coefficients of Friction at Various Speeds

Speed (m.p.h.)	Coefficient of Friction Calculated by Formula	Coefficient of Friction Determined by Experiment (Ave. of 41 Tests)	Difference
1	1.377		
5	0.796		
10	0.628	0.621	0.007
20	0.496	0.502	0.006
30	0.432	0.432	0.000
40	0.392	0.389	0.003
50	0.363		
60	0.341		
70	0.324		

It is quite evident that the calculated equation describes very accurately the relationship of the coefficient of friction to speed for speeds from 10 to 40 miles per hour. Beyond 40 miles per hour the curve levels off as would be expected. For speeds under 10 miles per hour the curve goes up rapidly and whether it gives an accurate measure of the coefficient of friction at these speeds is open to question. This is evidenced by the coefficient of 1.377 for 1 mile per hour. However, even though the equation may be in error for the lower speeds the error has an insignificant

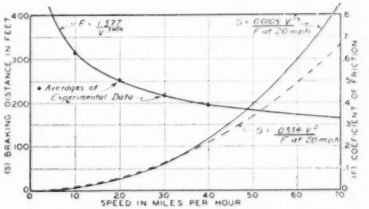


FIGURE 1 - BRAKING DISTANCE VS SPEED
COEFFICIENT OF FRICTION VS SPEED

1. The curve $F = \frac{1.377}{V^{.3408}}$ shows that there is close agreement between the theoretical curve and the four points based on experimental data.

2. The two curves giving braking distances (S) for various speeds show that braking distances are considerably greater at the higher speeds when using a varying coefficient of friction than when assuming that the coefficient of friction is constant for all speeds.

effect on the total braking distance for any appreciable speed.

Some idea of the size of the possible error is indicated by the braking distance determined by the use of the formula using a variable coefficient of friction and when calculated from a formula assuming a constant coefficient of friction of 0.628 for 10 miles per hour.

	Braking Distance
Based on variable F (for F = 0.628 at 10 m.p.h.)	4.6 feet
Based on a constant F (for F = 0.628 at 10 m.p.h.)	5.3 feet

Even if there should be no increase in the coefficient for speeds under ten miles per hour the maximum error would be only 0.7 feet. This is quite negligible even though the coefficient as determined by the formula does become very large for very low speeds.

Braking Distances Based on a Variable Coefficient of Friction

Since the coefficient of friction can be determined by the formula for any speed and since the total braking distance is equal to the sum of the products of each short interval of time and the speed during that interval it is possible to determine the formula for braking distance by integral calculus. As previously shown for the average coefficients of friction under consideration:

$$F = \frac{1.377}{V^{0.3408}}$$

If the speed is expressed in feet per second (v) this formula becomes:

$$\frac{1.377}{(0.68v)^{0.3408}}$$

From physics:

$$S = \frac{V^2}{2Fg}$$

where S = distance
v = velocity in feet/sec.
F = Coefficient of friction
g = Acceleration of gravity

Differentiating:

$$dS = \frac{v\,dv}{32.2\ F} = \frac{vdv}{32.2 \times 1.377 \over (0.68v)^{0.3408}}$$

$$dS = \frac{vdv \times (0.68v)^{0.3408}}{32.2 \times 1.377}$$

Integrating:

$$S = \int \frac{(0.68)^{0.3408} \times v^{1.3408}}{32.2 \times 1.377}\,dv$$

$$S = \left[\frac{(0.68)^{0.3408} \times v^{2.3408}}{32.2 \times 1.377 \times 2.3408}\right]_0^V$$

If the speed is expressed in miles per hour (V) this formula becomes:

$$S = .020725\ V^{2.3408}$$

Since this formula is based on a coefficient of friction of 0.496 at 20 miles per hour it may be made more general by correcting for the coefficient and making provision for using any coefficient of friction. The formula then becomes:

$$S = \frac{0.020725\ V^{2.3408}}{F\ (\text{at } 20\ \text{m.p.h.})} \times 0.496$$

or

$$S = \frac{0.01028\ V^{2.3408}}{F\ (\text{at } 20\ \text{m.p.h.})}$$

Because of the large decimals this formula is somewhat cumbersome to use. By changing the power of V to 7/3 and the constant to 0.0105 the formula is somewhat simplified and gives substantially the same results. As speeds increase the error becomes larger but it is only 2.8 feet at 60 miles per hour. Thus the formula recommended for practical use is as follows:

$$S = \frac{0.0105\ V^{7/3}}{F\ (\text{at } 20\ \text{m.p.h.})}$$

A table has been constructed to show the braking distances as calculated by three methods, all based on a coefficient of friction of 0.496 for 20 miles per hour.

The first formula in table III is based on the assumption that the coefficient of friction is constant and thus the stopping distance varies as the square of the speed. The second column is based on the exact formula as determined from experimental data. The third column of braking distances is based on the formula derived from the exact formula by rounding some of the figures.

Dry Surfaces

An analysis was made of some data obtained by General Motors Proving ground in which braking tests were made on good dry concrete from 20, 30, 40 and 50 miles per hour with brakes capable of locking all four wheels. From 28 to 32 tests were made at each speed by cars of various weights. Computations based on the average stopping distance for each speed indicated that the stopping distance varies as the 2.075 power of the speed.

Summary

Evidence that the coefficient of friction decreases with speed on wet roadway surfaces was obtained by Professor Moyer in his towing tests at Iowa

TABLE III—Braking Distances Based on Three Formulae*

Speed	$S = \frac{.0334\ V^2}{F\ (\text{at } 20\ \text{m.p.h.})}$	$S = \frac{.01028\ V^{2.3408}}{F\ (\text{at } 20\ \text{m.p.h.})}$	$S = \frac{0.0105\ V^{7/3}}{F\ (\text{at } 20\ \text{m.p.h.})}$
10	6.7	4.5	4.6
20	27.0	23.0	23.0
30	60.7	59.5	59.2
40	108.0	116.6	115.8
50	168.7	196.5	195.0
60	242.9	301.2	298.4
70	330.7	432.0	427.5

* F at 20 M.P.H. assumed equal to 0.496.

State College. An analysis of the data obtained from these tests indicates that the following formula gives values very close to the average values obtained experimentally for speeds from 10 to 40 miles per hour.

$$F = \frac{1.377}{V^{.3408}}$$ where F = Coefficient of friction, V = Speed in m.p.h.

A generalized statement of this formula becomes:

$$F = \frac{2.77 \times (F \text{ at } 20 \text{ m.p.h.})}{V^{.3408}}$$

If the above formula is used for determining a variable coefficient of friction then the formula for braking distances on wet surfaces becomes:

$$S = \frac{0.0105\ V^{7/3}}{F \text{ at } 20 \text{ m.p.h.}}$$ where S = Braking distance

For most wet surfaces it is believed that the above formula will give more accurate results than the formula commonly used:

$$S = \frac{1.07\ V^{2}}{32.2\ F}$$

At the higher speeds the distances obtained by the two formulas become substantially different, the formula using $V^{7/3}$ giving the greater distances.

BRAKES — FACTS AND FIGURES

On the basis of previous experience, upwards of 10 per cent of all cars to be checked in the Nation-wide Brake Emphasis Program (see page 205) will fail to meet requirements.

Brakes, good or bad, are called into play in nearly all traffic accidents. Many accidents would have been less serious or entirely avoided had all the brakes involved been good brakes.

While accident reporting in general is not in sufficient detail to determine exactly how great a factor brakes are in traffic accidents, there is ample evidence that brakes are a major cause. Records of fatal accidents in twelve states show that unsafe brakes were responsible for up to 11 per cent of the deaths.

In motor vehicle inspections made in New Jersey last year, 15 per cent of the total inspected failed to meet brake requirements. In New Hampshire, of the total cars inspected last year in a five month period, 19.5 per cent were rejected because of inadequate brakes. Those figures are regarded as indicative of conditions throughout the country.

That motor vehicle accidents interfere seriously with the war effort is shown by the fact that more than half of the persons injured or killed in traffic accidents are workers. In 1943 traffic accidents claimed the lives of 10,500 workers, and injured 350,000.

Today's cars, on the average, are nearly twice as old as in pre-war times and are naturally far more susceptible to breakdown.

The war-time strain on motor vehicles is shown by the increase in accidents attributable to vehicle defects. The percentage of fatal accidents which involved a defective vehicle increased from 8 per cent in 1941, and 10 per cent in 1942, to 15 per cent in 1943. One-third of the defects were reported as defective brakes.

Good brakes should stop a car at 20 m.p.h. within 30 feet after they are applied. Brakes which do not begin to grip until the foot pedal is within an inch or less of the floorboard often require up to 60 feet for stopping—or twice the legal distance required by most state laws. At higher speeds, poor brakes place the driver at a much more dangerous disadvantage.

Warrants for Rural Sidewalks

by F. B. CRANDALL and JOHN BEAKEY

DRIVERS have become accustomed to or grown up with the idea of pedestrians sharing the use of city streets; the same is not true of rural highways. Sidewalk facilities are usually available in cities, while the converse is true along rural highways, and, for this reason, the pedestrian use of rural facilities is looked upon as unusual and, perhaps, intrusive.

The Oregon State Highway Commission has recognized the problem as evidenced by the allocation of certain monies with which to construct sidewalks along rural state highways. There then remains the problem of the proper expenditure of the money available so that public interests will be best served and elimination of the pedestrian hazard will provide the greatest benefit as regards accident prevention.

The construction of footpaths or sidewalks along a highway in themselves contribute little to the elimination of the *hazard of crossing the highway*. This report is concerned primarily with the problem of the pedestrian *walking along the highway*.

It is difficult to establish fixed warrants for construction of a particular pedestrian facility. However, it is possible to establish relative indices as between a number of projects. The purpose of this study is to develop through the inter-relation of the several influencing factors a means of computing relative indices as between a group of several projects.

This article was extracted from Technical Report No. 44-3 of the Oregon State Highway Department, prepared under supervision of John Beakey (Mem. I.T.E.) and F. C. Crandall (Assoc. I.T.E.). Captain Beakey, Traffic Engineer, Oregon State Highway Department, is overseas now. Crandall is Acting Traffic Engineer.

Index of Hazard

Since vehicle volumes, pedestrian volumes, speed, and roadway conditions form the most tangible factors, they must certainly be taken into account in attempting to establish an Index of Hazard. Traffic, both vehicular and pedestrian, is highly seasonal in certain recreational, industrial, and agricultural districts, and in order to reflect the most hazardous conditions, volumes referred to hereinafter represent not year-around daily averages, but daily averages for the six months of maximum traffic.

While the factors contributing to accidents are no doubt many, the first four enumerated below seem to have the most important bearing on the problem:

1. Condition of Shoulder
2. Width of Roadway
3. Light Condition
4. Speed of Traffic
5. Miscellaneous

Assuming the density of the vehicle-pedestrian movement as being the prime factor bearing on relative hazard and the factors hereinabove as reflecting the special and modifying conditions, the Index of Hazard (I.H.) may be expressed as follows.

$$I.H. = Vt\ Vp\ (1 + F\text{-}1 + F\text{-}2 + F\text{-}3 + F\text{-}4 + F\text{-}5)$$

Where Vt is the Average daily 24-hour vehicle traffic volume for six months of maximum traffic.

Vp is the Average daily 24-hour pedestrian traffic volume for six months of maximum traffic.

F-1 is the Condition of shoulder.
F-2 is the Width of roadway.
F-3 is the Light condition.
F-4 is the Vehicular speed.
F-5 is the Miscellaneous.

Little is to be gained by using actual volume count values, and consequently to simplify the computations, numbers have been assigned to represent the various vehicle and pedestrian volumes.

Vt—Vehicle Traffic Volume

Average Daily Vehicular Volume for 6 Months of Maximum Traffic	2-lane Road	3-lane Road	4-lane Road
1 to 100	1	....	....
101 to 250	2	....	....
251 to 500	3	....	....
501 to 1,000	4	....	....
1,001 to 1,500	5	....	....
1,501 to 2,000	6	5	....
2,001 to 3,000	7	6	5
3,001 to 5,000	8	7	6
5,001 to 10,000	9	8	7
10,001 to 15,000	10	9	8
15,001 to 20,000	10	10	9
20,000 and over	10	10	10

Vp—Pedestrian Traffic Volume

Ave. Daily Pedestrian Volume for 6 Months of Maximum Traffic	Value of Vp
1 to 10	1
11 to 25	2
26 to 50	3
51 to 100	4
101 to 150	5
151 to 200	6
201 to 300	7
301 to 500	8
501 to 1,000	9
1,000 and over	10

F-1—Condition of Shoulder

During a large part of the year the weather of Oregon is such as to discourage walking on the shoulders. A pedestrian will not use a rough, wet, dusty, or rocky path when immediately adjacent there is a smooth hard surfaced shoulder.

Condition of Shoulder	Value of F-1
Shoulder in good condition throughout year	.0
Shoulder suitable for use in dry weather and reasonably smooth	.1
Shoulder suitable for use in dry weather, but rough	.2
Shoulder suitable for use in dry weather, but use restricted by parked vehicles, etc.	.3

Lack of Sidewalk Facilities Extending Beyond The Corporate Limits of a City.

School Children Must Use Roadway of Necessity in Suburban Areas When No Sidewalks Are Provided.

Shoulder condition such as to discourage use throughout year	.4
No shoulder (confined as in a bridge or tunnel) or of a width inadequate to remove the pedestrian from close proximity to vehicular traffic	.5

F-2—Width of Roadway

Three- and four-lane roadways not only divert a certain percentage of vehicular traffic further from the shoulders, but provide more room in which the motorist may maneuver to avoid pedestrians.

Distance From Inner Edge of Shoulder to "Centerline"*	Value of F-2
20 and over	.0
18 to 19	.1
16 to 17	.2
15	.3
14	.4
13	.5
12	.6
11	.7
10	.8
9	.9
8 and less	1.0

* With the exception of three-lane highways, "Centerline" refers to the marked or otherwise accepted line of demarcation between opposing streams of vehicular traffic. In the instance of three-lane highways, "Centerline" is taken as the mid-point of the center lane.

F-3—Light Condition

The following values have been assigned to the factor F-3 according to the percentage of pedestrian traffic during hours of darkness—if the highway is adequately lighted these values must be discounted to some degree.

Per Cent of Pedestrian Volume During Darkness	Value of F-3
2% or less	.0
3% to 5%	.2
5% to 10%	.4
10% to 15%	.7
15% to 20%	1.0
20% and over	1.5

F-4—Vehicular Speed

Accident *reports* do not indicate directly that speed constitutes a major factor, but this is probably due in part to the fact that the accident *reports* are made out by the motorist—a dead pedestrian is in a poor position to present his version.

Speed at Which 85% of the Vehicles Travel at or Below—MPH	Value of F-4
20 and less	0.00
21 to 25	0.03
26 to 30	0.09
31 to 35	0.15
36 to 40	0.21
41 to 45	0.27
46 to 50	0.34
51 to 55	0.42
Over 55	0.50

F-5—Miscellaneous

In addition to the items included in the first four factors, the degree of hazard is influenced by other factors that are quite difficult to evaluate. These include the type and extent of culture adjacent to the highway, sight distance, prevailing weather condition, etc., and the extent to which these factors affect each problem is largely a matter of personal judgment. To preclude variances in personal judgment, the factor F-5 is restricted to a range of 0.0 to 0.5.

Relative Warrant

The foregoing discussion has dealt with the derivation of *indices of hazard* as between various sections; however, it does not follow that such indices may be used in determining the *relative warrant* of projects in the matter of construction priority. Relative warrant values or indices must recognize, in addition to inherent hazards, the item of construction costs.

When past accident records are available and show a positive value some weight must be accorded thereto notwithstanding the fact that pedestrian accidents are largely a matter of chance and subject to wide range of incidence.

Neglecting the actual casualties on record, *the relative warrant can then be said to be directly proportional to the index of hazard and inversely proportional to the cost per mile* (C-m). The introduction of the accident factor is subject to a range of possibilities particularly as regards the weight which should be accorded this item in any computation of relative warrant. The effect of this factor on the relative warrant should undoubtedly be positive in quality. The quantitative effect—whether the factor should be direct or exponential in character—is a matter open to debate. Lacking sufficient data on which to base a de-

A Typical Oiled Footpath Constructed to a Grade and Separated From the Shoulder. This type of Footpath Is Typical of Recent Construction Practice.

tailed study, the factor of accidents has, for the purpose of this study, been confined to one having straight line characteristics.

In accordance with the foregoing discussion the following formulae may be written.

$$\text{Relative Warrant} = \frac{\text{(Index of Hazard)}}{\text{(Cost per Mile)}} \quad \frac{(1 + \text{Casualties})}{\text{per mile per year)}}$$

or

$$\text{Relative Warrant} = \left[\frac{V\ V\ (1 + F_1 + F_2 + F_3 + F_4 + F_5)}{t\ p \qquad Cm}\right]\left[1 + CM\right]$$

Where Cm is the estimated cost of project in hundreds of dollars per mile.
CM is the Casualties per mile per year.

Summary

It is to be borne in mind that the application of the Index of Hazard and Relative Warrant to any single project is in itself of little value; however, when an extensive program has been prepared, the use of these indices enables a governmental agency to expend funds at those locations where the most good will be derived from the expenditures.

Studies to date on the subject of accident evaluation have produced a wide range of values notwithstanding which there is definite indication that the benefits accruing to this element will assume major proportions and in many instances exceed one or both of the other component benefit elements —mileage and time. In evaluating this benefit item not only pedestrian accidents but the over-all accident experience in the section should be given consideration.

When rural sidewalk construction has progressed further, and "before and after" comparisons can be made, it is believed that the data necessary for a more exact mathematical evaluation will be available. It is gratifying, however, that in applying the above described formula to actual sections of highway, indices are obtained consistent with the actual accident experience.

AUTOMATIC BRAKE OPERATES BY RADAR

The application of the principle of radar to locate objects is not new. According to recent scientific findings, the bat flies blind in the dark because he uses radar to steer him away from obstacles. The bat emits a series of super-sonic squeals, too high-pitched for human ears to register, and the echo of these squeals, bouncing back from buildings, trees, etc., guides the bat. The scientists discovered the secret of the bat's night "vision" when they found that only by taping up his ears could his ability to "see" objects in total darkness be stopped.

Kenneth W. Jarvis, Vice-President of the Sheridan Electro Corporation of Chicago, has invented a similar cheap (under $50 per unit) radar device to safeguard an automobile or other vehicle by automatically stopping it before it can collide headon with another object. The device might be turned on at night or in heavy fog to prevent running into obstructions such as a stalled vehicle. There is obvious application to rail traffic to prevent rear-end collisions. The inventor envisions its possible use on an automobile in constant operation to prevent too-close spacing between moving vehicles.

The Device

Quoting the inventor, the device operates as follows: A car would have located in the front, presumably near the head-light position, one or more loud speakers. These loud speakers are

of the type wherein the radiated sound is concentrated into a narrow beam directly in front of the car. They are energized with electronic type ocscilators. The frequency used would be in the order of 25,000 to 40,000 cycles so as to be well above the audibility range. Thus, the fact that these horns will continually send sound out in front of them would not impress itself on anyone in the position to listen. These sound waves radiate and upon reaching the object in front of them, reflect in various directions, including directly back toward the car. Here the reflected sound wave is picked up and impressed back into the same electronic apparatus which is generating the emitting sound waves. The time is takes to go and come is measured by proper devices. Probably the most practical of these for this particular purpose is known as the wobble method. In this, the sound wave is changed from say, 40,000 to 30,000 cycles per second and then repeats this 40,000 to 30,000 cycles sequence. Now, assume that the automobile sends out a sound wave which strikes an object 50 feet in front. The sound wave going from the car to the object and back would travel through 100 feet and, as sound travels approximately 1,000 feet per second, this means a lapse or interval of one-tenth of a second. When this wave started out, it started as a 40,000 cycle note. By the time the reflection comes back to the car one-tenth of a second later, the wobbling oscillator has decreased in frequency from 40,000 to 39,000 cycles; thus the difference between the reflected note (40,000 cycles) and the radiated note when the reflected note reaches the car (39,000 cycles) is 1,000 cycles. This 1,000 cycle difference note indicates an object 50 feet in front of the car. An object 25 feet away would produce a 500 cycle note, etc. (This is somewhat over simplified, as it omits the Doppler effect, but is correct in principle.)

Automatic Braking

The inventor envisions possibly correlating the device with the carburetor or brakes to stop a car automatically before it reaches an object. Or it might be set to maintain a minimum of 50 feet spacing between cars at 30 m.p.h.—say, and greater distance at greater speed. Naturally the device would not be effective for objects approaching from the side, unless they were in front of the vehicle, and it would not detect objects on the other side of an obstruction, such as a hill or building. The limit of operation would probably be in the order of several thousand feet.

Announcement of this invention was made by Mr. Jarvis at the seventeenth annual meeting of the Radio Manufacturers Association and Institute of Radio Engineers last November.

★ ★ ★

A Safety Expert—is a person, who, away from his native habitat, passes as an exacting professional on the basis of being able to turn out with prolific fortitude, infinite strings of incomprehensible formulae calculated with micromatic precision from vague assumptions which are based on debatable figures taken from inconclusive experiments carried out with instruments of problematical accuracy by persons of doubtful reliability and questionable mentality for the avowed purpose of annoying and confusing a hopelessly chimerical group of fanatics referred to altogether too frequently as "Safety Conscious."—Anon.

Postwar Transit vs. Automobile Traffic

by CHARLES STEPHENSON

IN the United States, the transition from war to peace will inevitably produce an environment in which each industry will struggle to maintain or to achieve a strong relative position.

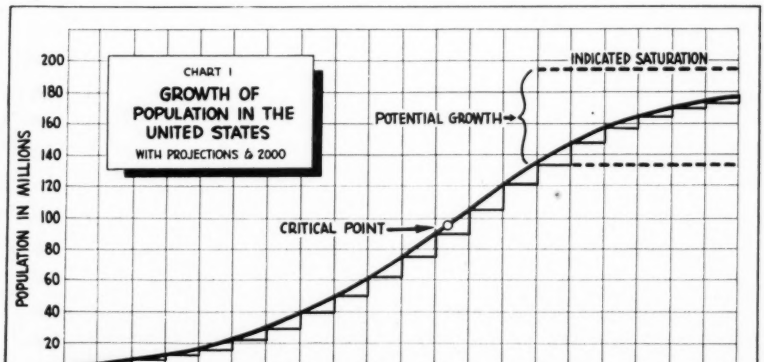
Transportation, performing a basic and indispensable function in our economic and social structure, will also experience a period of adjustment between the components of which it is comprised, as each type of carrier seeks to exploit its competitive position by increasing its social value and its relative efficiency.

The author is Research Assistant of the American Transit Association. This is an abstract from "Transit's Prospects for Postwar Traffic" appearing in A.T.A. 1944 Convention in print.

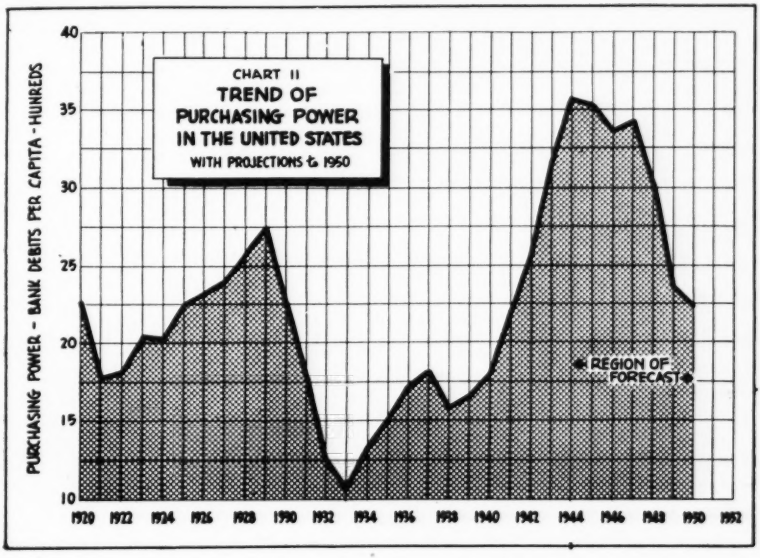
Historical Record Significant

Our interest here, however, is the field of local passenger travel; particularly the extent to which public transit carriers may expect to hold their own against the competition of the private automobile, and the post-war outlook for transit riding volume when present restrictions on the use of automobiles are removed.

For a time the transit industry seemed destined to be entirely engulfed by the rapidly mounting competition of the individual vehicle and the street congestion which it created. All companies suffered severely as the mounting tide cut deeper and deeper into transit riding. Many people, both outside and inside the industry, seriously questioned the destiny of transit as an important factor in the field of local travel. In reviewing the past three



Population Increases Over the Next Quarter of a Century Will Be Almost Equal to the Increases Since 1920. Transit Riding Will Benefit From This Growth.



24-Year Record of Fluctuations in Purchasing Power With Forecast to 1950. Total Travel Habit Correlates With This Factor More Closely Than Any Other.

decades it is significant that the transit industry was able to survive under such handicaps and to rebound in a great war emergency to demonstrate its inherent social value and utility.

Despite this demonstration, there are many who are convinced that war traffic has merely given the industry a temporary lease on life and that it is destined in the post-war period, with the resurgence of the automobile, to resume its downward trend to oblivion. There is little justification for this view.

Great Opportunity Ahead

Quite a contrary outlook results from a careful study of the underlying factors bearing upon the future of public transit in cities. The inevitable conclusion from such a study is that the transit industry stands on the threshold of the greatest opportunity for development and expansion in its history.

Three Fundamental Factors

Any examination of the future outlook for this industry must take into consideration three fundamental factors that bear upon its destiny. These are: (1) the long term trend of population; (2) changes in general business activity; and (3) the number and use of private automobiles. Analysis of the time tracks of these factors affords a key to the determination of the future volume of total local travel and of the proportions of this volume which may be expected to use public transit service. The study is particularly interesting in that it indicates the expectable volume of transit riding, assuming no great improvement

in present facilities, service, fare structures or merchandising effort. It is even more interesting in that it also indicates the volume of local travel by automobiles within the territory now served by transit lines, from which progressive management may attract new business through improved service and intensive merchandising.

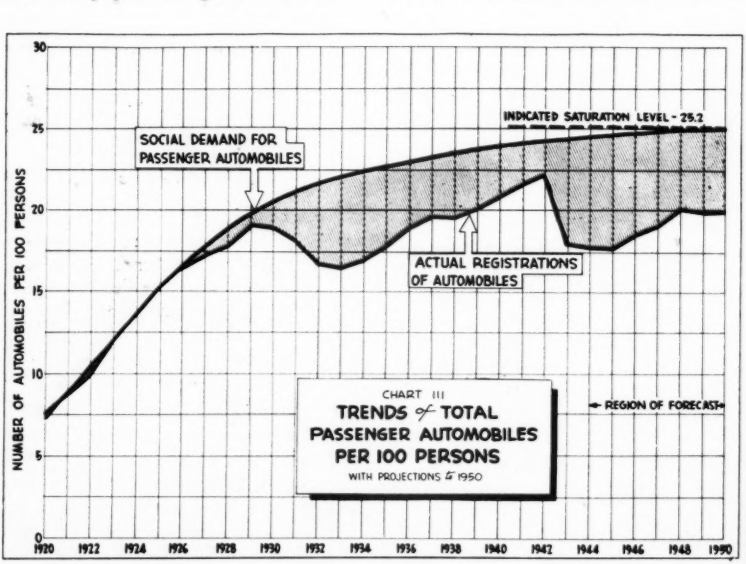
Population Still Growing

Since 1933, population has increased by ten million persons, and over the next quarter of a century there will be added another twenty-five million. If we assume that the transit industry will merely revert to its pre-war relative position in relation to automobile travel (which is a doubtful assumption), it will, nevertheless, inevitably experience a substantial increase in volume of traffic attributable to the effect of population growth alone.

Riding Fluctuates With Purchasing Power

The second important force bearing upon the transit industry is produced by changes in purchasing power. A number of careful studies extending over many years indicate that transit traffic correlates more highly with bank debits per capita than with any other economic series. The reason is that bank debits per capita closely reflect average purchasing power. It is also worthy of note that total local travel, i. e. travel on transit lines plus automobile riding within the competitive area of transit operations, moves almost in perfect correlation with per capita bank debits.

Based upon an extension of harmonic components which have been observed to operate on our economy and which have been traced back to 1854, it is indicated that the ten-



The Country's Car Population Density Is Approaching a Saturation Level From Which Periodic Contractions Will Be Registered in Times of Declining Power. Lag in Automobile Registrations Below the Curve of Social Demand Is Attributable to the Influence of the Business Activity Factor and Has Reduced the Depressive Effect of Automobiles on Transit Riding.

dency of purchasing power will be toward a low point in 1950 which will be followed by several years of upward movement. Within the general contemplated down move to 1950, it is assumed that the war will end in 1945 and in that year purchasing power will be only slightly less than in 1944. Definitely lower purchasing power is expected in 1946 during the conversion period. 1947 indications are for an advance in purchasing power to be followed by substantial contractions extending to 1950.

Conservative View of Outlook

Most other post-war predictions as to the trends of general business activity are considerably more optimistic. Accordingly, our assumptions may be taken as presenting the most gloomy view of future business trends that is likely to occur, and this consideration should be kept in mind in evaluating the balance of this study of the transit outlook. It should also be noted from Chart II, that despite the indicated decline from 1947 to 1950, the *general trend* of business activity shown by the chart is distinctly upward and may be expected to resume after the 1947-1950 adjustment.

Saturation Level for Autos

We come now to the third important factor to be considered. This is the effect of automobile ownership and use on transit riding. Chart III shows the trend of automobile registrations per 100 persons from 1920 to 1944 with projections to 1950. Superimposed on the chart is a growth curve representing the social demand for automobiles. Two important features are to be observed: (1) an indicated saturation level of approximately 25.0 cars per 100 persons; and (2) the variations in registrations due to changes in purchasing power. The saturation level is of interest in that it indicates the limits on automobile ownership in relation to population.

Automobile density is approaching a level at which new owner sales will be reduced to negligible values. But the variation in registrations attributable to changes in purchasing power are of greater significance as indications of the fact that saturation has already been so nearly reached. A comparison of Charts II and III indicates a striking correlation between business activity and automobile registrations from 1926 to 1941. The lag in automobile registrations below the indicated curve of social demand, resulting from the influence of the business factor is clearly evident. This has restrained the depressive influence of the automobile on transit riding since 1926, and has caused automobile ownership to lag to such an extent that it will now require some eight or ten years to reach the indicated curve of social demand under the most favorable business conditions.

Autos Increase Travel Habit

It is true that automobile usage has seriously affected the volume of transit traffic. But the automobile has also enormously increased the total volume of local travel *and the travel habit*. This latter effect has in part been beneficial to transit riding.

The period during which the automobile had its greatest detrimental effect on public transit was the period up to 1926 when new car sales were following the curve of social demand and when the factor of novelty had its greatest force. Since 1926 the competition of the automobile has been partly offset by the fact that transit has benefited from the increased overall riding habit created.

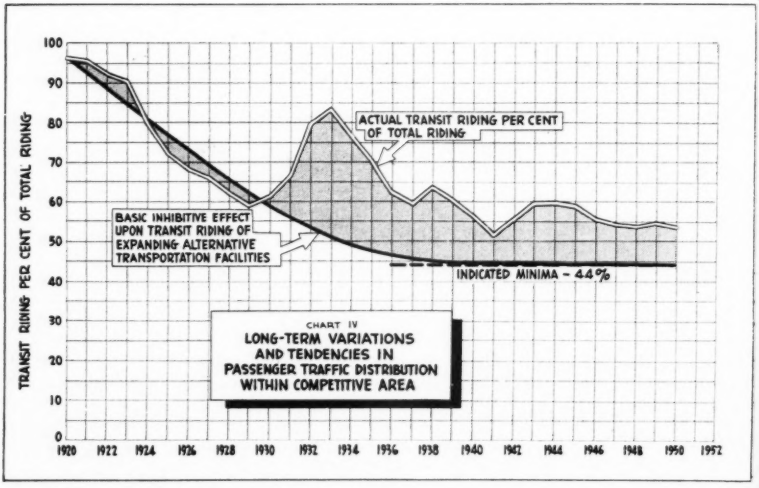
There is striking evidence in support of these statements. For example, in the year 1920 and in the year 1941 purchasing power was almost identical. But in the year 1920 the overall riding habit per capita (transit and

automobiles) was 117.5, while in 1941 it was 149.7, an increase of 27.4%. In 1920 transit carried 98 per cent of total local riding, but in 1941 the proportion carried by transit was only 51 per cent. Therefore, if there had not been an increased incentive to ride, or riding habit, produced by the automobile the total transit rides in 1941 would have dropped to 8 billion passengers. But the actual figure was 10.2 billion. The difference represents the extent to which the transit industry benefited from the increased total riding habit despite the competition of the automobile.

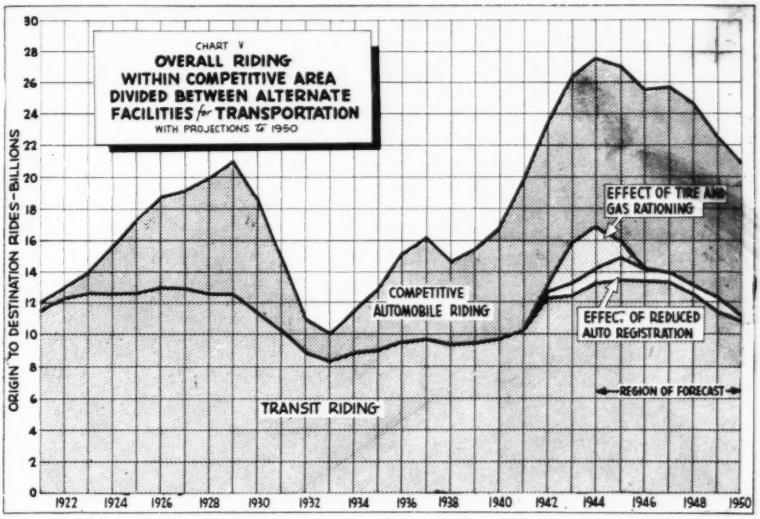
Looking at this another way, it is probable that if the automobile had merely cut into transit riding without at the same time vastly increasing total riding habit, transit traffic in 1941 would have been 35 per cent less than in 1920. Actually, it was only 17 per cent less. In 1941, a shift of only one in each ten automobile rides would have completely restored transit volume to the 1920 level.

Here then is an indication of the post-war opportunity for the transit industry. The automobile, while being a serious competitor has enormously increased the total volume of local riding. The riding habit in American cities is phenomenal compared to foreign cities where automobile density is low. The transit industry is thus offered a vast potential for expanded traffic through promotional effort built around modernized equipment, improved service, modernized fare structures and the use of modern sales effort.

Because wartime traffic has wrought havoc with transit equipment, practically the entire fleet of the industry will have to be replaced at an early date and with a new modern fleet at hand, the industry will have its golden opportunity to expand and improve its revenue position.



The Distribution of Traffic Between Transit and Automobiles Within the Area in Which These Two Forms of Transportation Compete, Fluctuates and Is Extremely Sensitive to Changes in Purchasing Power. The Chart Shows the Extent to Which Transit Riding Has Cut Back Into Automobile Riding at Various Times During the Period in Response to the Effect of the Business Cycle.



Effect of Auto Usage

Confirmation of this view is given by Chart IV showing the long-term variations in passenger traffic distribution between transit and automobiles within the area in which these two forms of transportation are in competition. The chart shows that the inhibitive effect of automobile usage upon transit traffic has been almost exhausted. The irregular area on the chart shows the extent to which the transit industry has cut back into automobile riding at various times throughout the years in response to the external forces of the business cycle. The minima of transit's share in the overall riding when business activity is most favorable to the automobile, is indicated to be in the neighborhood of 44 per cent. Progressive management applied to this situation has every reason to expect results which would greatly improve both the competitive and absolute position of the transit industry.

Reciprocal Effect of Transit and Autos

The competitive effect of the private automobile upon mass transit riding is registered in two ways: (1) increasing number of automobiles; and (2) variations in use. Just as the volume of mass transit riding rises and falls with the tides of business activity, so also does the degree of usage of the private auomobile, and inasmuch as the relationships between transit and automobile riding is inverse, these phenomena produce a reciprocating action. Thus, in a period of rising business activity, transit riding increases at a decreasing rate, relatively speaking, due to deflection to the private automobile. On the other hand in a period of falling business activity, transit riding is cushioned by a shift from private automobile use to transit riding. This behavior of the riding public has accrued to the benefit of the transit industry by gradually reducing the amplitude of cyclical swings in transit traffic demand. This

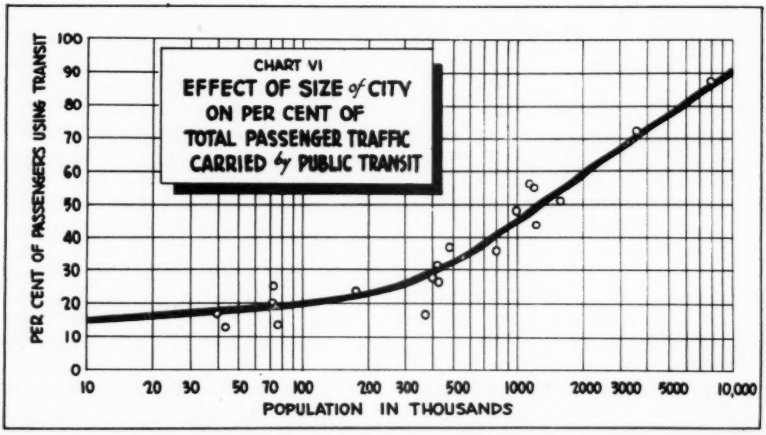
condition has an important bearing on long term size of plant and equipment.

Through a multiple correlation analysis it has been possible to isolate the separate effects of the several factors as outlined above, which bear upon transit traffic. These independent effects have furnished valuable insight into the transit industry, but combining them into a net resultant has yielded a historical panorama which is even more interesting. This is shown in Chart V. Here the overall riding within the area in which autos and transit are competitive is shown broken down between the two groups. Explanation of the method of determining the volume of automobile riding which may properly be considered to be competitive with transit, would require more detailed discussion than can appropriately be included in this article. It is based, however, on sound statistical principles and has been repeatedly demonstrated in individual studies made in a number of cities.

Note how the distribution of riding between transit and automobiles changes, due to fluctuations in business activity, throughout the period covered by the chart. Comparing the movements of overall riding with the movements of business activity as shown in Chart II, the remarkable concomitance of variation can be observed. By contrast, note the relative stability of the movements of transit traffic insofar as cyclical amplitude is concerned.

Auto Riding Increased in War

As a matter of further interest attention is directed to the war period where there is shown the effect upon transit traffic of restricted automobile use, divided between that portion accounted for by (1) reduced registrations and (2) tire and gas rationing. Of the 65 per cent increase in traffic from 1941 to 1944 experienced by transit lines, 40 per cent came from the restriction of automobile use, and 25 per cent from increased business activity. It is also to be observed that, *despite rationing*, the overall volume of automobile riding within the competitive area of transit operations, *increased* during the war years.



The Proportion of Total Local Riders Carried by Transit Varies With the Size of the City Served and Increases as the Size of the Community Increases.

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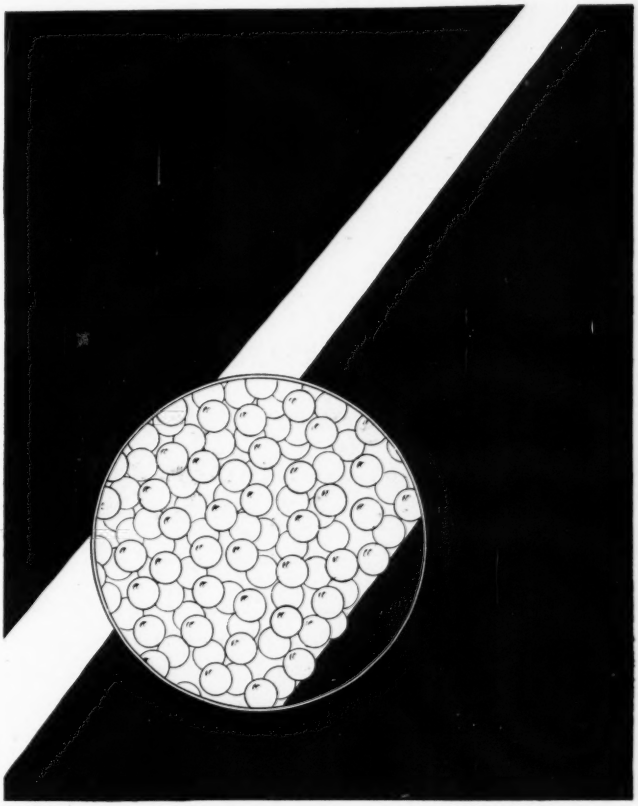

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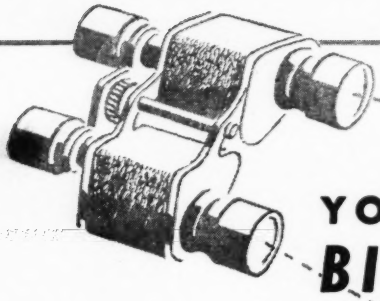

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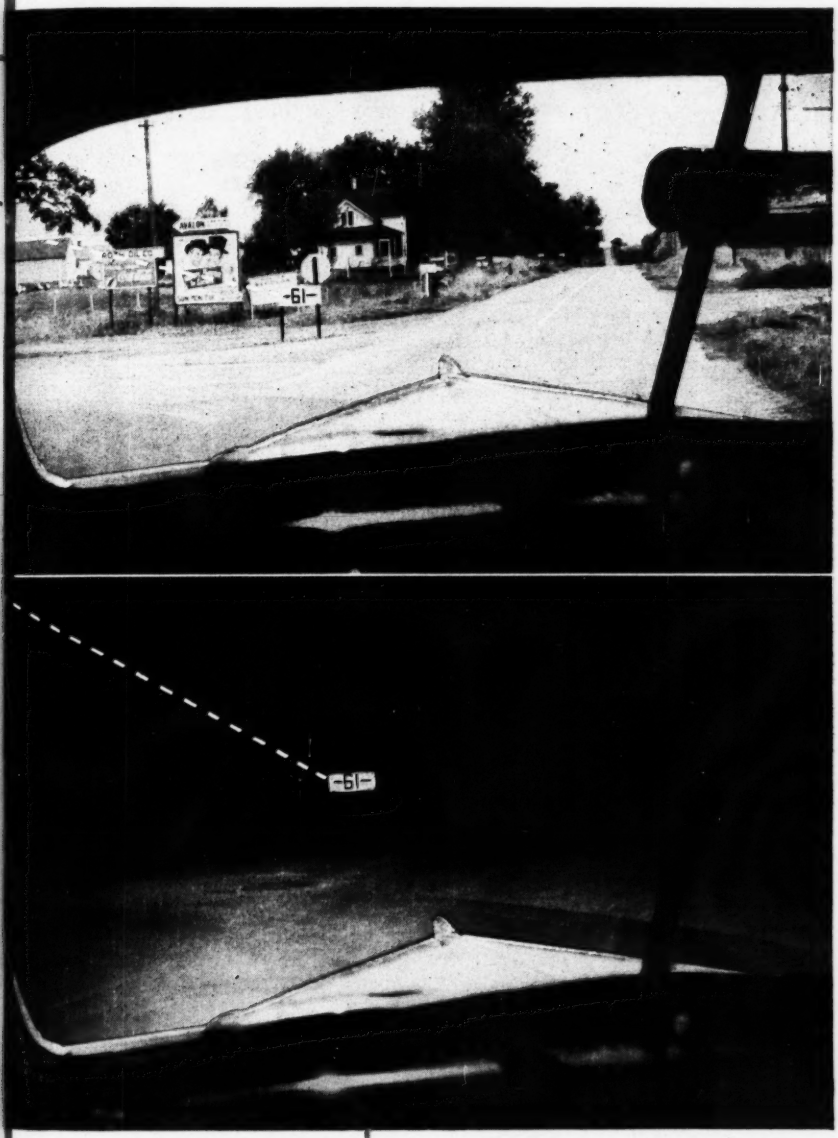

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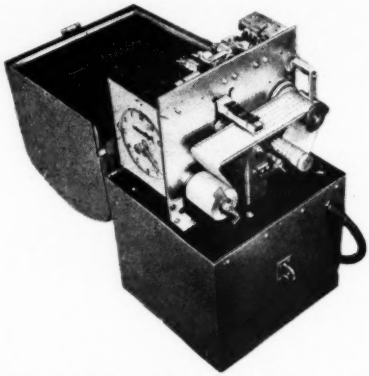

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One-Way, Through, and No-Left-Turn Streets

by MAXWELL HALSEY

ONE-WAY streets, through-traffic streets and no-left-turn intersections will become more necessary in both small and large cities after the war, in order to cope with congestion and accidents due to vastly increased urban traffic volumes anticipated by authorities. The majority of arteries in large cities, and *virtually all in smaller towns*, must rely on less elaborate traffic engineering devices. The following discussion concerns traffic routing.

The modern trend toward one-way streets can easily get out of bounds. For instance, a certain medium sized city recently designated all downtown streets for one-way traffic. No competent study had been made before this action, and the blanket order drew immediate protest from residents and merchants.

Such actions can give a bad name to a good traffic device. The basic principle of traffic engineering is that solutions to traffic problems require detailed study to learn the *real problem*. Every traffic control device that restricts some traffic freedom for the general good—has its disadvantages as well. Without experienced engineering counsel and advance study, no city can get maximum results even from erecting a stop sign.

Traffic routing involves one-way streets, through-streets, and turning restrictions. A brief review of each follows.

Maxwell Halsey (Mem.) is Executive Secretary, Michigan State Safety Commission. This article originally appeared in *American City* Magazine.

One-Way Streets

There are three types of one-way streets: 1. Carrying traffic in one direction at all times; 2. Carrying traffic one-way at all times, but with the direction of flow reversed at certain peak hours; 3. Carrying traffic one-way during peak hours only, and two-way at all other times.

Advantages of one-way streets are larger traffic capacity per lane, reduction of accidents and congestion, more ability to synchronize traffic lights to reduce stop-start driving, and less conflict with curb parking.

Disadvantages: motorists often drive extra blocks to reach destinations; one-way signs must be erected at every intersection; and confusion (and often increased accidents) result until motorists become familiar with the system.

On streets where one-way rules vary at different hours of the day, W. A. Van Duzer, Traffic Director for Washington, D. C., has found that a flashing red arrow neon sign is the only way to insure accident reduction. The sign is controlled by a time switch, and turns on at the moment the one-way rules go into effect.

A post-war improvement will be an arrow with two points, Van Duzer states—one being lighted in the morning, but shut off in favor of the other point when the direction of flow is changed. This neon arrow reminds motorists of the direction of flow in force at the moment, and avoids confusion when the flow is reversed.

When properly established and given a trial, one-way streets prove popular with merchants and motorists alike.

Narrow and congested streets often lend themselves well to one-way designation — but seldom should such a street be made one-way unless a nearby parallel street can handle traffic moving the opposite way.

Related to the one-way street is the wide street on which one or more extra lanes in the middle are assigned to the heavy morning peak-hour flow, and this designation reversed for the evening peak. The lanes require special marking, but the operation often is well fitted for a wide street that is the only good route between important sections of town.

Through Streets

A through street is an artery connecting one section of town with another and on which movement is expedited by signs requiring traffic on intersecting streets to stop before entering or crossing the artery. At major intersections, traffic lights are used rather than stop signs.

Advantages: traffic is moving on fewer streets with less congestion; accidents and delays on neighborhood streets are reduced; and traffic control methods can be more simple and effective when confined to major arteries.

Disadvantages — which proper controls can overcome: motorists often drive too fast on through streets and ignore right of pedestrians and cross traffic; also, cross traffic may be delayed unreasonably if parallel through streets are too closely spaced.

With every street about as good as the next for traffic, it is important that a balanced through-street system be set up and that the arteries selected be those that are natural paths between important points of traffic interest. Too often, stop signs and traffic lights are erected when accidents focus attention on specific intersections.

By-Pass Routes

A through-traffic by-pass around the downtown district, and another around the outskirts of town, is a sound modern trend. These beltlines not only relieve crowded inner streets of traffic that have no business to transact in the central area, but also serve as traffic distribution routes for vehicles that *do have* inner destinations. Such traffic circles around the beltline to the point nearest its inner destination before congesting the inner streets.

The beltlines also encourage a more compact growth of the city and the downtown area, offsetting the tendency of developments to spread in narrow fringes out along the main arteries radiating from the center.

Cities that have created downtown and outer beltlines have clearly shown to downtown merchants the benefits of removing through traffic in this business section. Space is now provided for people who have business to transact downtown, their business far offsetting any slight loss of casual trade from passing motorists. So long as both the penetrating and by-pass routes are clearly marked, leaving the choice to the motorist, cities have everything to gain from circumferential by-pass routes.

Turning Restriction

Control of turns on busy streets becomes more essential as traffic increases. Special traffic signals are well suited for busy intersections where

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turning problems exist. And on crowded cross-city arteries, prohibition of all left turns during rush hours is sound. Good signs are essential, stating clearly the hours during which left turns are illegal. Patience is required while motorists become acquainted with the prohibitions.

When barred from turning left, a motorist desiring to make such a turn must (a) circle around the block to the right, or (b) preferably turn right at a corner in advance of his desired turning point, and then circle around the block to the left.

Detroit's Grand River Avenue, where left turns are banned permanently, has a system of signs for important intersections which guide motorists into the most convenient routes for making the left-turn detour. The motorist is directed into a right turn in advance of his desired left-turn point, and side-street signs lead him around the block and back to the proper crossing. This system has reduced accidents and congestion drastically, says Ross C. Harger, director of the city's traffic control division, vastly offsetting the slight inconvenience to the 4 per cent of motorists who want to turn left.

What can be done in special traffic routing problems is shown by the report of Sidney Anger, Lansing, Michigan, city traffic engineer, who had an accident - congestion situation around the parking lots of two adjoining war factories when factory shifts changed at the same time. Anger used factory plant officers to direct traffic, due to a police shortage. The traffic light at the main intersection was turned off, and the entire street serving the parking lots was given over to one-way traffic at the rush period. Two center lanes of the street were assigned to traffic crossing the main intersection, and the two side lanes were used for cars making left and right turns.

In spite of a two-block detour for traffic running counter to the one-way movement, congestion and accidents were virtually eliminated immediately.

★ ★ ★

Tires Present indications are that commercial motor vehicle operators will receive only about one-half of their estimated tire requirements during the first quarter of 1945, Col. J. Monroe Johnson, director of the Office of Defense Transportation, announced recently. The urgent military demand for tires for combat vehicles, trucks, jeeps and other military transport was given as the reason for the drastic cut.

Commending commercial motor vehicle operators for the many millions of tire miles that they have saved through various conservation efforts, Colonel Johnson said, "despite these savings many more million miles could still be saved through joint cooperative efforts with other carriers. Many motor trucks are moving over the highways empty or partially loaded while traffic stands waiting on the docks and platforms of other motor carriers.

"We cannot rely on getting tires from somewhere, somehow or by some unforseen improvement in present conditions. The serious conclusion is: If tires aren't saved now, rubber borne transportation will be seriously affected, if not impaired, months hence when the hot weather with its heavy toll on tires begins."

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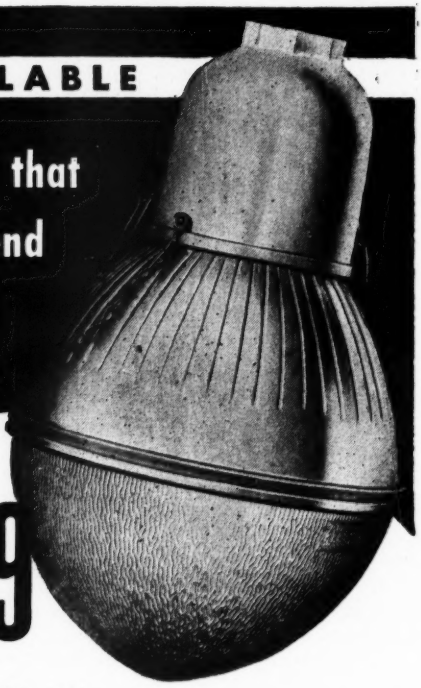

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DEVELOPMENT OF TRAFFIC DATA BY CALIFORNIA HIGHWAY DIVISION

The records of the California Division of Highways reveal that from its earliest beginning factual data rather than opinions were used to determine highway improvements. In order to measure these needs and know what kind and how much traffic there was, actual field traffic counts were made.

The first regularly adopted form of which there is a record was used in 1913. A record was made of all vehicles passing a given location for a period of 14 hours each day for the full 7 days of a week, counts beginning at 7 A.M. and ending at 9 P.M., and broken down into two-hour periods. Vehicles recorded were classified as follows:

Single Horse:
- Light Vehicle
- Heavy Vehicle

Two or More Horses:
- Light Vehicle
- Heavy Vehicle

Automobile:
- Runabout
- Touring Car
- Motor Trucks
- Motorcycles

"Light Vehicle" was defined as meaning "a buggy, democrat wagon, or any vehicle other than an automobile which is used usually for pleasure or light business purposes." "Heavy Vehicle" meant "a farm wagon, milk wagon, dump wagon, grocery or provision wagon or any vehicle except an automobile, which is used for carrying heavy loads." "Runabout" was defined as "an automobile built to carry but two people."

It is to be noted that the information sought concerned *rural* traffic, no provision being made for recording pedestrians or bicycles.

In 1924 counts were being made regularly at approximately 200 locations. For a time such counts were taken during each of the four seasons, spring, summer, autumn, and winter. In 1926 semi-annual counts had been settled upon and were continued without radical change until 1934, counts being taken in mid-January and mid-July of each day during two successive days, Sunday and Monday, for the 16-hour period from 6 A.M. to 10 P.M., the traffic totals being shown for each hour. At the same time at certain stations counts were taken for the full 24 hours in order to develop the necessary factors for expanding the 16-hour records.

First California Statewide Count

In 1934, through the cooperation of the Civil Works Administration in providing the many thousands of field recorders needed for simultaneous recording, a statewide simultaneous survey was conducted. Since that time, with the exception of a minor number of necessary modifications, counts have been conducted at the same stations semi-annually in mid-January and mid-July. At certain stations the full 24-hour count was made on the mid-Monday of each month throughout the year which served to indicate seasonal variation.

While the knowledge of traffic provided by this continuous and regular program of field recording is basically invaluable for the proper direction of the activities of the highway organization, there is, of course, the need in many instances for special knowledge of further details which may be of peculiar and deciding influence in the review of individual projects. This is *always* true of intersections if anything other than the most minor or elementary treatment is involved.

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Subject to such modifications as may be apparently desirable due to conditions unique to the location being studied, the normal intersection survey records traffic by both type and direction in 15-minute-interval totals, special forms being used for these counts.

In reciting this outline of the manner in which we (the California Highway Division) go about the work of acquainting ourselves with needed information on the traffic we must serve, there has been no intention to present any of the methods as being uncommon or exceptional in themselves. In one important respect, however, we do perhaps occupy a position of more than ordinary advantage. That is the possession of broad and quite comprehensive background of factual traffic data sufficiently complete as to detail and marshalled in such manner that it is *usable*.

Traffic data can not be manufactured or produced at will in some artificial way in a laboratory. It must be accumulated *over the years* and *throughout the system*. And if in the field-gathering the records kept have been so simplified as to constitute little more than the total sum of vehicles observed, such records quickly reveal their inadequacy the moment any attempt is made to put them to real use. Without certain essential detail, totals may indeed be worse than useless in that they lend themselves to decisions based on mere speculation. A similar lack of substantial value can be ascribed to information which must be based on data acquired during a single count or isolated survey, which in themselves may be sufficiently complete as to detail but which, since they must stand alone, in reality represent only conditions as of the date the observations were made.

The California Division of Highways is unusually fortunate in this regard by reason of many years of continuous records of traffic covering the entire system and sufficiently detailed for nearly all essential needs. Directly tied in as they are with the state-wide comprehensive Transportation Survey of 1934, and carefully supplemented by many special studies, these records provide reliable support for judgment in the wide variety of highway problems which must be decided daily.

This is a digest of an article appearing originally in the *California Highways and Public Works* magazine.

"THAR'S METAL ON THOSE HIGHWAYS"

by CHARLES M. UPHAM

In these days of aging and unreplaceable automobile tires, the menace of punctures grows daily. Tacks, nails, bits of wire and scraps of iron and steel on our highways threaten worn casings and tubes as never before. What can be done about it? We pass on to you the action taken by the Minnesota Department of Highways in rounding up such tire saboteurs.

Before snow and frozen road surfaces halted operations this winter, the department's road magnet covered 550 miles of Minnesota highways and collected the amazing amount of 2,580 pounds of these metal tire threats. When we consider that this haul averaged 100 pieces to the pound, it will be seen that over a quarter of a million pieces which might have injured tires have thus been taken out of circulation and added to the nation's scrap drive.

C. L. Motl, Minnesota's highway maintenance engineer tells us that this important highway service was given at a cost of approximately $1.00 per mile which covers all expenses involved in the operation including depreciation of equipment used. He explains that the electro-magnet bar is 8 feet long which required four passages over a 32-foot highway. On paved roads, the magnet treatment was applied only to the shoulders, since he points out that pavements and bituminous surfaces are relatively free of scrap metal. Cost of one passage per mile is estimated at 30 cents. The unit travels 10 miles per hour.

But speaking of punctures, we might add that it is not always metal that causes the trouble. Some years ago, a large Middle Western tire service station kept a careful record of the odd things that damaged tires. The list contained some astonishing items. Included were the beaks and bones of fowls, wild and domestic, sharp stones, insects, glass of every description, nut shells, wood of all shapes and kinds and even pasteboard objects, not to mention bottle caps, razor blades, hair pins, nails, tacks, wires and one ferocious-looking railway spike picked up far from a railroad track. "It seems as though almost anything may cause a puncture on the highway if conditions are right," said the station manager in commenting on the almost unbelievable collection.

The author, an Affiliate Member of I.T.E., is Engineer Director, American Road Builders Association.

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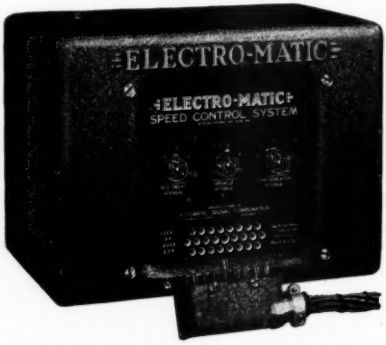
O and D—The I. B. M. cards used in San Antonio's recent Origin and Destination study were printed in Spanish as well as English. A great many residents in and around San Antonio speak only Spanish. A. N. McCandliss (Jun. I.T.E.), Traffic Engineer with the Michael Baker, Jr., Consulting Engineers, directed the studies.

ELECTRO - MATIC
SPEED CONTROL SYSTEM



Model S-20 Speed Controller

ELECTRO-MATIC SPEED CONTROL SYSTEMS limit vehicle speeds on curves, underpasses, bridges, approaches to towns, school zones and the like. The elements of the system are an Electro-Matic Speed Controller, Vehicle Detector, Traffic Signal, and sometimes a C-A-R Indicator Signal. Vehicles approaching the controlled zone at allowable speeds proceed without stopping, on a "Go" indication. The speeding motorist is confronted by a red signal at the stop line if his speed is not reduced to a safe limit. In addition provision is made for signalling the approach of a vehicle from the opposite direction where conditions make it desirable.

"Traffic Regulation With Intelligence"

AUTOMATIC SIGNAL CORPORATION

NORWALK, CONN. CHICAGO, ILL.

ITE NEWS AND PERSONALS

New York I.T.E. Section

The March meeting will be held on the 28th at the George Washington Hotel, New York City. All Institute members and friends are invited to attend and hear Guy Kelcey discuss "The Federal Highway Act of 1944 and Our Post-war Highway Program."

T. M. Matson, Chairman of the N. Y. Section, I.T.E., reports that details of adoption of by-laws will be discussed at this meeting, especially the matters of dues, annual meeting (Sectional) and titles of officers.

The Institute Board of Direction has formally approved the formation of an official New York Metropolitan Area Section.

Any Institute Members or friends who may be in New York on March 28 should plan to attend, and notify Institute headquarters.

Washington, D. C., I.T.E. Section

February 28 was the date of the last dinner meeting, with E. H. Holmes as speaker.

The Institute Board of Direction voted to officially recognize the Washington Section, to include an area within 50 miles of Washington, D. C., and at least 31 Institute members have signified their desire to become charter members of the new Section.

New Joint Committee Established

T. M. Matson, Lloyd Braff, and Grant Mickle have been appointed as the Institute representatives on the new joint Committee on Traffic Engineering Techniques and Organization. Other organizations having official representation are the American Association of State Highway Officials and the American Public Works Association.

Correction for 1944 Proceedings

W. A. Van Duzer, Director of Vehicle and Traffic, District of Columbia, addressed the following letter to the editor of TRAFFIC ENGINEERING:

"I wish to correct a possible misapprehension arising from the report of Mr. Martin E. Bruening, on Control of Traffic at the Fifteenth Annual Meeting of the Institute of Traffic Engineers as reported in the 1944 Proceedings.

"The first sentence of the last paragraph on page 59 of those proceedings reads, "Objections to this method are that in the event of lamp failure confusing and misleading directions are given." The neon "Walk" signals in use in Washington, D.C., are so connected that no false "walk" indication can be shown. The word "Don't" can be illuminated only in series with the word "Walk." Therefore, any breakage of this tubing or of the wire will result in the signal going dark at the time when the "Don't Walk" would otherwise be shown. These signals cannot, therefore, give a misleading direction to pedestrians."

California Appoints Safety Commission

Governor Earl Warren has appointed a thirty-man California State Traffic Safety Commission to begin immediately to combat the rising tide of vehicular and pedestrian accidents. Institute members included among the thirty citizens are R. T. Dorsey, Los Angeles City Traffic Engineer, and E. B. Lefferts, Automobile Club of Southern California.

You can't convince a mother that street lighting costs too much!

Nighttime traffic accidents are on the increase—in spite of restrictions on travel. Muggings and purse-snatchings make the streets unsafe for women and children. Juvenile delinquency baffles the police. How much longer can this go on before the people rise up and *demand* corrective measures?

Now is the time for you to do something about it. Identify yourself with a public service that can do more than anything else to reduce accidents and crime. Plan a postwar program of street lighting modernization adequate to the needs of the people.

IF you are puzzled about how and where to start, we will be glad to help by showing you how other municipal officials are solving problems similar to yours . . . Write The Street and Traffic Safety Lighting Bureau, 155 East 44th Street, New York, New York.

GOOD STREET LIGHTING—THE SIGN OF A GOOD PLACE TO LIVE

PERSONALS

Capt. John Beakey (Mem. I.T.E.), on leave as Traffic Engineer with the Oregon State Highway Department, was wounded in action on a Normandy beachhead last October. It is reported he laid on the beach in a dressing station for 10 days. Shrapnel had entered his lungs. Beakey was in Paris at last report.

Col. Harry Stedman (Mem. I.T.E.) writes from overseas, "Just a note to let you know I'm still on top and feeling fine. I see Lt. Col. Bud Yost often and he is doing his usual fine job in Transportation. Saw Ed. Wetzel and tried to get him with my old HQ but he is on a very interesting assignment now. Doing fine. I am in same work. Things move fast here, busy all the time. Am now serving with my old C. G. who is a dynamo and a real soldier. I enjoy reading TRAFFIC ENGINEERING. . . . I can see progress (much). Guess we will have to be students when we return as we will be behind."

John M. Paver (Affl. I.T.E.), formerly Director of the Traffic Audit Bureau, recently accepted the position of Vice-President and General Manager of the National Outdoor Advertising Bureau. Paver has been managing director of the Traffic Audit Bureau since his honorable discharge from the Army Air Forces last August. Prior to his discharge he had seen 18 months service as a Lieutenant Colonel in the European Theatre as an assistant chief of staff. He was in the first group of officers sent abroad to arrange for transportation and supply to American Air Forces based in England.

Before the war, Col. Paver was director of field service for the bureau. Earlier, he was associated with Dr. Miller McClintock as Harvard Fellow and Research Associate, which association resulted in publication of "Traffic and Trade," and creation of the Traffic Audit Bureau.

With Dr. McClintock and Albert Hasse, Col. Paver directed the Advertising Research Foundation's window display researches. At one time, Col. Paver took part in promotion activities at Northwestern University in collaboration with Dr. Walter Dill Scott. He also had been associated with the product research division of the Sunland Sales Corporation of California.

Announcing his appointment, Mr. Skelton said, "Col. Paver brings to his new position a 20-year background and experience in organization, market, traffic and advertising analysis, and his acquaintance with leading advertisers, agencies and plant operators throughout the country fits him admirably for his new management responsibility."

E. F. Clark (Mem. I.T.E.) has been released from active Army duty and is back on the job with the New York State Department of Public Works. Clark was a Captain in the A.U.S. His home address is 248 Centre Avenue, New Rochelle, N. Y.

James G. Hayden (Assoc. I.T.E.), formerly with Associated Transport, Inc., is now overseas with the Army Transportation Corps as a civilian Highway Transportation Engineer.

Ralph F. Gross (Assoc. I.T.E.), formerly with the Chicago Park District, is now overseas with the Army Transportation Corps as a civilian Highway Transportation Engineer.

Nathan Cherniack (Mem. I.T.E.), Economist for the Port of New York Authority, is confined to his home since he fell and broke his ankle last month.

TRAFFIC SIGNALS by CROUSE-HINDS

Pedestrian Actuated Controllers

Here are a few of the common types available:

PA11—Normally steady green on main street and steady red on cross street. Press button, controller goes through one cycle of color sequence.

PA12—Normally flashing green or amber on main street and flashing red on cross street. Press button, controller goes through one cycle of color sequence.

PA13—Normal stop and go operation. Press button, pedestrian interval and clearance interval are inserted in color sequence for one cycle. Total cycle remains constant and pedestrian time is subtracted from main street green.

PA14—Normal stop and go operation. Press button, pedestrian interval and clearance interval are added to color sequence for one cycle. Total cycle is increased by pedestrian interval.

PA15—Operates same as PA13 during the day. At night, time switch turns to normal indication of flashing green on main street and flashing red on cross street. Press button, controller gives amber clearance interval, then pedestrian interval, then clearance interval, and returns to normal flashing indication.

CROUSE-HINDS COMPANY
SYRACUSE 1, NEW YORK, U.S.A.

GO — CAUTION — STOP

When writing to advertisers, please mention TRAFFIC ENGINEERING

Positions Available

Akron, Ohio: Associate engineer, $3600 - $4140; assistant engineer, $3060-$3420; junior engineer, $2100-$2460; engineer aid, $1740 - $1920. Citizens Post-war Planning Committee, 608 Municipal Building, Charles E. Coltrin, Secretary.

Providence, Rhode Island: Director, Civic Planning and Traffic Board, Providence Chamber of Commerce. The job is principally promotional, to interpret planning to the public, to arouse public interest, and to insist that development of an over-all land use pattern should have priority over competing projects which may or may not fit into such pattern. Salary, $4000. Address inquiries to Edward Winsor, Chairman, 162 Westminster Street, Providence 1, Rhode Island.

Toledo, Ohio: Charles E. Hatch, Secretary - Engineer, Toledo Planning Commission, Court House, is accepting applications for 4 positions: (1) assistant planning engineer, (2) person to do research and handle publications, (3) person with traffic and master street plan experience, and (4) person with land use, platting and zoning experience. Salaries: $3600-$4800. No examination. College graduates preferred.

Tennessee: The Tennessee State Planning Commission will soon have positions available on its staff for assistant community planner, $2400-$3000; community planner, $3000-$3600; principal community planner, $3600-$4400; and assistant industrial economist, $3000-$3600. The work of the first three consists of technical assistance to planning agencies in the smaller Tennessee cities; the duties of the economist consist of field work and preparation of reports on resource and industrial development. Address inquiries to Hayden B. Johnson, Executive Director, Tennessee State Planning Commission, 408 State Office Building, Nashville.

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INSTITUTE ACTIVITIES TEN YEARS AGO

Items from Traffic Engineering, March 1935 Issue

D. Grant Mickle, formerly associated with Miller McClintock, has joined the staff of Jensen, Bowen and Farrell, public appraisal engineers, which has set up a traffic and transportation department covering highway traffic, consulting work, and general highway transport engineering. Mr. Mickle conducted traffic research at the Erskine Bureau for street traffic research at Harvard University, was employed for several years in the traffic division of the Massachusetts Department of Public Works, and directed the public works studies on the Massachusetts highway accident survey, following which he entered the employ of the U. S. Bureau of Public Roads.

Mr. Maxwell N. Halsey has recently accepted appointment as Assistant Director of the Harvard Bureau for Street Traffic Research (formerly the Albert Russell Erskine Bureau). The University is to be congratulated in this appointment, as Mr. Halsey's experience peculiarly fits him to assist Dr. Miller McClintock in carrying out the rapidly expanding activities of the Bureau.

Harold Hammond has accepted the post of traffic engineer with the National Bureau of Casualty and Surety Underwriters, following Maxwell Halsey's resignation.

Charles A. Rex applied for transfer of membership in grade.

Polarized Traffic Signs

A method for making light-polarizing traffic signs that are visible to night-driving motorists only when they are using the wrong headlights is the subject of a patent which was recently issued to Polaroid Corporation, Cambridge, Mass. The traffic signs are designed for vehicles fitted with both a polarizing headlight system for country driving and an ordinary system for city driving.

The novel warnings, "Shift to polarized beam" and "Shift to unpolarized beam" would be visible to the driver when he uses the wrong headlight system required for the area in which he is driving. However, the warnings would be invisible when he uses the right system.—*Commercial Car Journal, November,* 1944.

Bicycle Manual Released by Kansas

The Kansas Department of Safety and Traffic Control has prepared a "Bicycle Manual" for distribution to 4-H Clubs and other interested organizations. The cover design portrays the glamorous Kansas bird, the "Jayhawk" in khaki with a rifle on his shoulder and the insignia of a "Top-Kick" on his arm. A poem entitled "In for the Duration" explains the induction of the Jayhawk and ends in a plea of buy stamps and bonds. The relation between the cover design and bicycle riding is explained by the statement that few bicycle riders will get any satisfaction out of the sport until the war is won, and that buying bonds will bring the brothers and daddies home sooner.

Traffic Conference Postponed

In accordance with the recent government request, the sixteenth Annual Safety Conference and Exposition scheduled for March 20 to 23, New York City, has been postponed. As outlined in the January issue of TRAFFIC ENGINEERING, the Institute of Traffic Engineers in cooperation with the Greater New York Safety Council, planned the five traffic and vehicle sessions. Announcement will be made at a later date regarding plans for the Conference.

France — The Renault Company, bus, automobile factory in France (and in Europe) is to be confiscated, the Provost French Government decrees. The thought is that under State control, Renault will cease to exist as a factor on the market. Under German occupation every automobile factory in France was operated for the Reich, and a German official ran every factory. So great were the penalties for rebellion that there was no trouble.

QUALIFICATIONS FOR MEMBERSHIP INSTITUTE OF TRAFFIC ENGINEERS

Quoting from the I.T.E. Constitution, Article II, and By-Laws, Article I:

ARTICLE II. SECTION 1. The membership of the INSTITUTE shall consist of Members, Associate Members, Affiliates, Juniors, and Honorary Members. Members, Associate Members and Juniors shall be professionally engaged in the practice of traffic engineering.

Member

ARTICLE I. SECTION 1. A Member shall be not less than thirty (30) years of age and shall have been in the active practice of engineering for at least ten (10) years and shall have been in responsible charge of work in one of the recognized branches of engineering for at least five (5) years. For at least five (5) years he shall have been engaged in the practice of traffic engineering and for at least

two (2) years of this period he shall have been in responsible charge, and shall be qualified to conceive, design and direct traffic engineering work.

Associate Member

SECTION 2. An Associate Member shall be not less than twenty-five (25) years of age and shall have been in the active practice of engineering for at least eight (8) years. For at least three (3) years, he shall have been engaged in the practice of traffic engineering and for at least one (1) year of this period he shall have been in responsible charge.

Affiliate

SECTION 3. An Affiliate, at the time of admission, shall be a person who is contributing substantially to the advancement of the Traffic Engineering profession through outstanding achievement in a related field, in which he shall have been engaged for at least ten (10) years, five (5) years of which he shall have been in responsible charge of important work. At no time shall an invitation to Affiliate Membership be extended if the number of Affiliate Members equals or exceeds 20 per cent of the total number of Members and Associate Members.

Junior

SECTION 4. A Junior shall be not less than twenty-one (21) years of age and shall have been in the active practice of engineering for at least five (5) years. For at least one (1) year he shall have been engaged in the practice of traffic engineering.

SECTION 5. The membership of a Junior in the INSTITUTE shall cease when he becomes thirty-five (35) years of age unless he be previously transferred to the grade of Associate Member.

Honorary Member

SECTION 6. An Honorary Member shall be a person who has performed notable and outstanding services in the interest of the profession of traffic engineering. At no time shall there be more than five (5) Honorary Members.

Interpreting Experience

SECTION 7. In considering the qualifications of candidates for the grade of Member, Associate Member, and Junior, graduation in engineering from a school of recognized standing shall be equivalent to four (4) years of active practice in engineering, and the satisfactory completion of each year of work in an engineering school of recognized standing without graduation, shall be equivalent to one-half (½) year of active practice. Graduation in a course other than engineering from a college or university of recognized standing shall be considered equivalent to two (2) years of active practice. Full-time post-graduate work in engineering in a school of recognized standing shall be equivalent to an equal time in active practice, and part-time post-graduate work shall be given appropriate credit. Provided, however, that no candidate shall receive credit for more than four (4) years of active practice in engineering because of educational qualifications.

SECTION 8. An applicant for the grade of Member who submits more than ten (10) years of engineering experience but who is deficient in traffic engineering experience shall be permitted to substitute such additional engineering experience, provided it is of professional grade, in lieu of traffic engineering experience, two (2) years of such additional experience being considered equivalent to one (1) year of traffic engineering experience, provided, however, there must be offered not less than three (3) years of traffic engineering experience of which at least two (2) years must be in responsible charge. An applicant for the grade of Associate Member, who submits more than eight (8) years of engineering experience, but who is deficient in traffic engineering experience shall be permitted to substitute such additional engineering experience, provided it is of professional grade, in lieu of traffic engineering experience; two (2) years of such additional engineering experience being considered equivalent to one (1) year of traffic engineering experience, provided, however, that there must be offered at least two (2) years of traffic engineering experience, of which at least one (1) year must be in responsble charge.

SECTION 9. Engineering work of professional grade, which may be substituted for a portion of the experience in traffic engineering, as provided in Sec. 8 of this article, shall include experience in engineering after the applicant is twenty-one (21) years old, during which he has been engaged in engineering work of a higher grade than that of draftsman, instrucment man and inspector, or in similar grades in which the applicant is working under direct supervision, or in positions where the personal responsibility and technical knowledge required are small.

SECTION 10. Membership in one of the Founder Engineering Societies shall be accepted as proof of the necessary engineering experience, other than traffic engineering experience, required for admission to the equivalent grade in the INSTITUTE.

SECTION 11. Engineering teaching shall be considered the equivalent of active practice in engineering and if the applicant holds the grade of assistant professor, or its equivalent, such teaching shall be considered as responsible charge.

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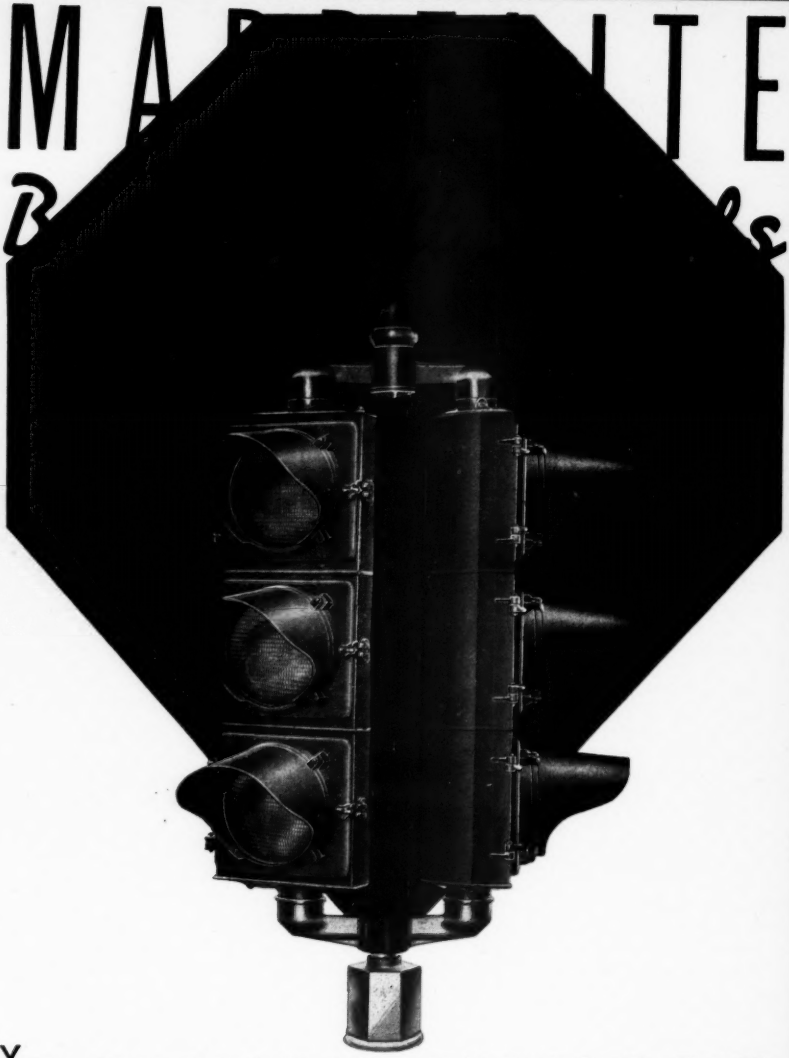

YOU can determine by just looking at this advanced design of a Two Way, Three-Color adjustable Signal that it is BETTER-BUILT.

Note the reinforced aluminum mounting brackets that replace the conventional pipe and fitting assembly. A compact, sturdy arrangement, eliminating small, minor parts.

You bet! It is BETTER-BUILT quality.

That isn't all, but it gives an idea of why Marbelite Signals are approved by numerous State and City Traffic Departments as well as Traffic Associations, and why there are so many thousands of Marbelite Signals in use in these Cities and States.

Familiarize yourself with other Marbelite features, such as the unbeatable optical unit. You will be proud to have such fine quality Signals regulating traffic in your community.

THE MARBELITE COMPANY, INC.

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